CLAIMS

We Claim:

1. A system for generating at least one of tire, ground, and tire/ground data for an pneumatic tire having a casing forming a hollow inner portion for containing a gas, the pneumatic tire in contact with a ground surface, the system comprising:

a radar transmitter, located within the hollow inner portion of the pneumatic tire, for generating a radar signal towards a portion of the pneumatic tire in contact with the ground surface;

a radar receiver for receiving a reflected signal from at least one of an interface between the gas and the casing and an interface between the casing and the ground surface; and

means for analyzing the reflected signal to produce at least one of tire, ground, and tire/ground data.

2. The system of claim 1, wherein said radar signal comprises an ultra-wide band radar pulse.

3. The system of claim 2, wherein said radar transmitter comprises:

a pulse repetition rate function generator for generating a pulse signal for triggering a radar pulse;

an impulse function generator, coupled to the pulse repetition rate function generator, for receiving the pulse signal

and generating a wide-band radar impulse in response to the pulse signal;

a first amplifier, coupled to the impulse function generator, for amplifying the radar impulse and outputting an amplified radar impulse;

a first waveguide, coupled to the amplifier, for receiving and transmitting the amplified radar impulse; and

a first feedhorn, coupled to the first waveguide, for receiving the amplified radar impulse and transmitting the radar impulse toward the tire casing.

4. The system of claim 3, wherein said radar receiver comprises:

a switch, coupled to the pulse repetition rate generator and the first feedhorn through at least a portion of the first waveguide, for alternately receiving an input pulse from the pulse repetition rate generator and radar return signals from the first feedhorn;

a second amplifier, coupled to the switch, for amplifying the input pulse and the radar return signals;

a detector, coupled to the second amplifier, for detecting radar return pulse data from the radar return signals; and

a data port, coupled to the detector, for outputting radar return pulse data.

5. The system of claim 3, wherein said radar receiver

comprises:

a second feedhorn, for receiving reflected radar signals;

a second waveguide, for receiving and transmitting the reflected radar signals;

a switch, coupled to the pulse repetition rate generator and the second waveguide, for alternately receiving an input pulse from the pulse repetition rate generator and radar return signals from the second feedhorn;

a second amplifier, coupled to the switch, for amplifying the input pulse and the radar return signals;

a detector, coupled to the second amplifier, for detecting radar return pulse data from the radar return signals; and

a data port, coupled to the detector, for outputting radar return pulse data.

6. The system of claim 1, wherein the means for analyzing the reflected signal outputs tire data representing an amount of tire casing deflection.

7. The system of claim 6, wherein the amount of tire casing deflection is determined by measuring a time difference between a transmitted radar impulse and a received reflected pulse from the tire casing.

8. The system of claim 1, wherein the means for analyzing the reflected signal outputs tire/ground data representing an

amount of ground deflection.

9. The system of claim 8, wherein the amount of ground deflection is determined by measuring a time difference between a transmitted radar impulse and a received reflected pulse from the ground.

10. The system of claim 1, wherein the means for analyzing the reflected signal outputs ground data indicating at least one soil property, wherein the soil property is determined by measuring amplitude characteristics of a received reflected pulse from the ground.

11. A method of generating at least one of tire, ground, and tire/ground data for an pneumatic tire having a casing forming a hollow inner portion for containing a gas, the pneumatic tire in contact with a ground surface, the method comprising the steps of:

generating a radar signal, using a radar transmitter located within the hollow inner portion of the pneumatic tire, towards a portion of the pneumatic tire in contact with the ground surface,

receiving a reflected signal in a radar receiver, from at least one of an interface between the gas and the casing and an interface between the casing and the ground surface, and

analyzing the reflected signal to produce at least one of tire, ground, and tire/ground data.

12. The method of claim 11, wherein said radar signal comprises an ultra-wide band radar pulse.

13. The method of claim 12, wherein said step of generating a radar signal comprises the steps of:

generating, in a pulse repetition rate function generator, a pulse signal for triggering a radar pulse,

receiving, in an impulse function generator coupled to the pulse repetition rate function generator, receiving the pulse signal and generating a wide-band radar impulse in response to the pulse signal,

amplifying, in a first amplifier coupled to the impulse function generator, the radar impulse and outputting an amplified radar impulse,

receiving and transmitting, in a first waveguide coupled to the amplifier, the amplified radar impulse, and

receiving, in a first feedhorn coupled to the first waveguide, the amplified radar impulse and transmitting the radar impulse toward the tire casing.

14. The method of claim 13, wherein said step of receiving a reflected radar signal comprises the steps of:

alternately receiving, in a switch coupled to the pulse repetition rate generator and the first feedhorn through at least a portion of the first waveguide, an input pulse from the pulse repetition rate generator and radar return signals from the first feedhorn,

amplifying, in a second amplifier coupled to the switch, the

input pulse and the radar return signals,

detecting, in a detector coupled to the second amplifier, radar return pulse data from the radar return signals, and

outputting, from a data port coupled to the detector, radar return pulse data.

15. The method of claim 13, wherein said step of receiving a reflected radar signal comprises the steps of:

receiving, in a second feedhorn, reflected radar signals,

receiving and transmitting, in a second waveguide, the reflected radar signals,

alternately receiving, in a switch coupled to the pulse repetition rate generator and the second waveguide, an input pulse from the pulse repetition rate generator and radar return signals from the second feedhorn,

amplifying, in a second amplifier coupled to the switch, the input pulse and the radar return signals,

detecting, in a detector coupled to the second amplifier, radar return pulse data from the radar return signals, and

outputting, from a data port coupled to the detector, radar return pulse data.

16. The method of claim 11, wherein the step of analyzing the reflected signal comprises the step of outputting tire data representing an amount of tire casing deflection.

17. The method of claim 16, wherein the amount of tire

casing deflection is determined by measuring a time difference between a transmitted radar impulse and a received reflected pulse from the tire casing.

18. The method of claim 11, wherein the step of analyzing the reflected signal comprises the step of outputting tire/ground data representing an amount of ground deflection.

19. The method of claim 18, wherein the amount of ground deflection is determined by measuring a time difference between a transmitted radar impulse and a received reflected pulse from the ground.

20. The method of claim 11, wherein the step of analyzing the reflected signal comprises the step of outputting ground data indicating at least one soil property, wherein the soil property is determined by measuring amplitude characteristics of a received reflected pulse from the ground.